



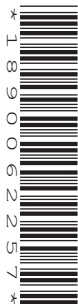
Oxford Cambridge and RSA

Friday 23 May 2025 – Afternoon

Level 3 Certificate Core Maths A (MEI)

H868/02 Critical Maths

Time allowed: 2 hours



You must have:

- the Insert (inside this document)

You can use:

- a scientific or graphical calculator



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name(s)

Last name

INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working.
- Give your final answers to a degree of accuracy that is appropriate to the context.

INFORMATION

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets [].
- This document has **20** pages.

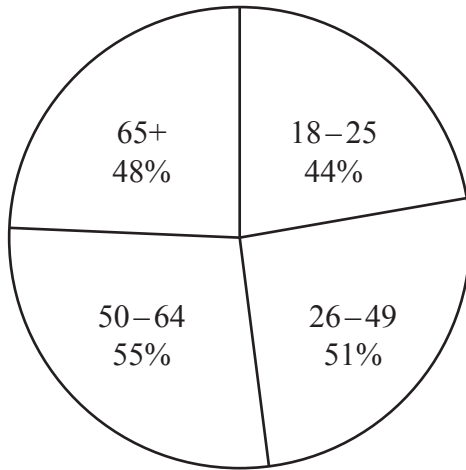
ADVICE

- Read each question carefully before you start your answer.

- 1 A council is considering changing the speed limit in their town from 30 mph to 20 mph.

The council does a survey to find out what percentage of adult residents approve of the change.
The council displays the results in a pie chart.

The pie chart shows the approval percentage by age group.



- (a) State **one** reason why this is **not** an appropriate way to display the data. [1]
- (b) Suggest a better way to display the data. [1]

1(a)	
1(b)	

- (c) A resident says that a journey at 20 mph takes one third longer than the same journey at 30 mph.

Is the resident correct?

Show your reasoning.

[3]

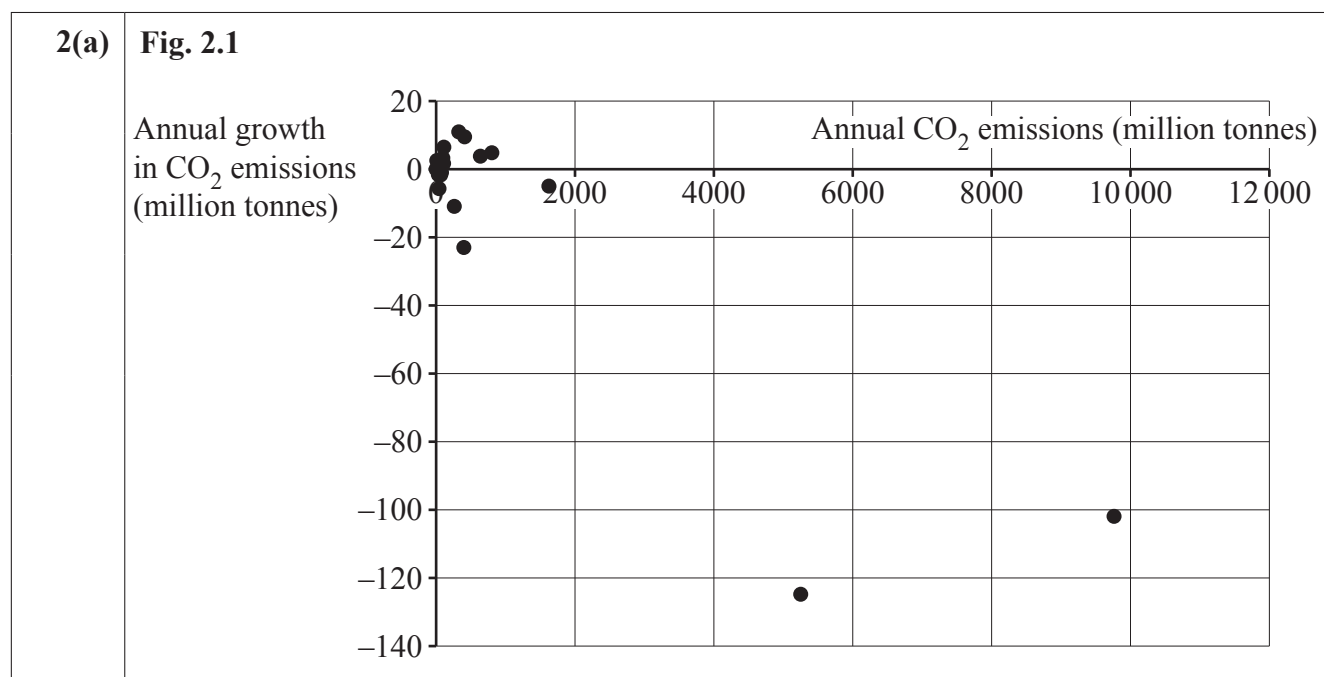
1(c)	

- 2 This question refers to article A in the pre-release material, ‘Carbon dioxide (CO₂) emissions’. You can find the article on the Insert accompanying this paper.

Fig. 2.1 shows the annual CO₂ emissions and the annual growth in CO₂ emissions for a sample of 30 countries in 2016.

Each point in the scatter diagram represents a country.

- (a) Circle the point in **Fig. 2.1** which shows the country that had the greatest **decrease** in its CO₂ emissions. [1]



- (b) State the type of correlation shown in **Fig. 2.1**. [1]
- (c) Explain briefly what is meant by “regression to the mean” in the context of annual CO₂ emissions. [1]
- (d) What feature in **Fig. 2.1** suggests that there might be regression to the mean? [1]

2(b)	
2(c)	
2(d)	

- (e) A student says that the units shown on the vertical axis of **Fig. 2.1** are wrong and should be % rather than million tonnes.

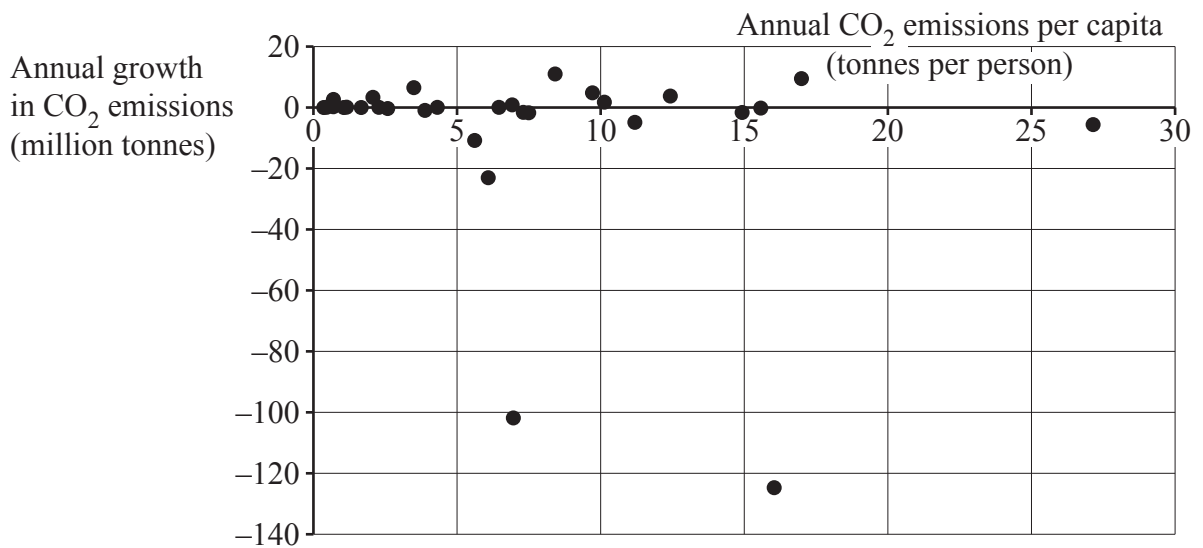
Explain, with reference to these data, why the student must **not** be correct.

[1]

2(e)	

- (f) **Fig. 2.2** shows the annual CO₂ emissions **per capita** and the annual growth in CO₂ emissions for the same 30 countries as **Fig. 2.1**.

Fig. 2.2



Estimate the population of the country which had the greatest **decrease** in its CO₂ emissions.

Use the data in **Fig. 2.1** and **Fig. 2.2**.

[3]

2(f)	

- 3** A first class university degree is the highest grade available.

The table below shows the percentage of degrees in England which were first class in each of the academic years ending 2012 to 2016.

Each percentage has been rounded to the nearest whole number.

Academic year ending	2012	2013	2014	2015	2016
% degrees which were first class	17	19	21	23	25

- (a)** Find the percentage point increase in the percentage of first class degrees from 2012 to 2016. **[1]**

- (b)** Show that the percentage of first class degrees has risen by approximately 47% from 2012 to 2016. **[2]**

3(a)	
3(b)	

- (c) A journalist assumed the trend in the table would continue and wrote this headline about the data:

‘All degrees will be first class by _____’

Work out the missing year for the headline.

Show your working and assumptions clearly.

[3]

3(c)	

- (d) Suggest **one** reason why the journalist’s prediction is very unlikely to happen.

[1]

3(d)	

- 4 Mia has been given a £30 voucher to spend in an online shop.

She wants to spend the whole voucher without adding any extra money to it.

Mia can choose one of two options, A or B, for a special offer.

Option A: The value of the voucher is increased by 20%.

Option B: Prices are reduced by 20%.

Which option is better value for Mia?

Show your working.

[5]

4		
	Which option is better value? Tick (✓) one box.	
	Option A	☐
Option B	☐	

5 **Fig. 5.1** is a design made by joining the midpoints of the sides of an equilateral triangle ABC.

This makes a smaller equilateral triangle.

The process is repeated with the new triangle and then one more time.

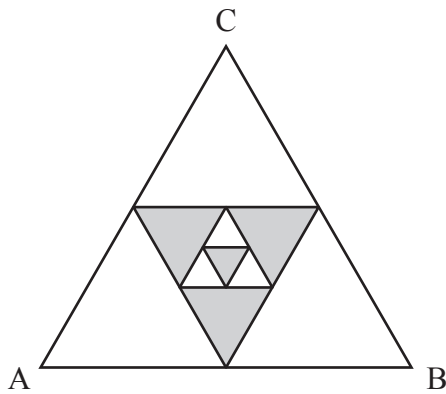
The design is then shaded as shown.

What fraction of the original triangle ABC is shaded?

You must show clearly how you have arrived at your answer.

[4]

5 **Fig. 5.1**



- 6 A computer program is being developed to identify text written by AI (Artificial Intelligence).

The program reads text and states whether it was written by a human or AI.

The probability of the program being **correct** or **not** correct depends on whether the text was actually written by a human or AI.

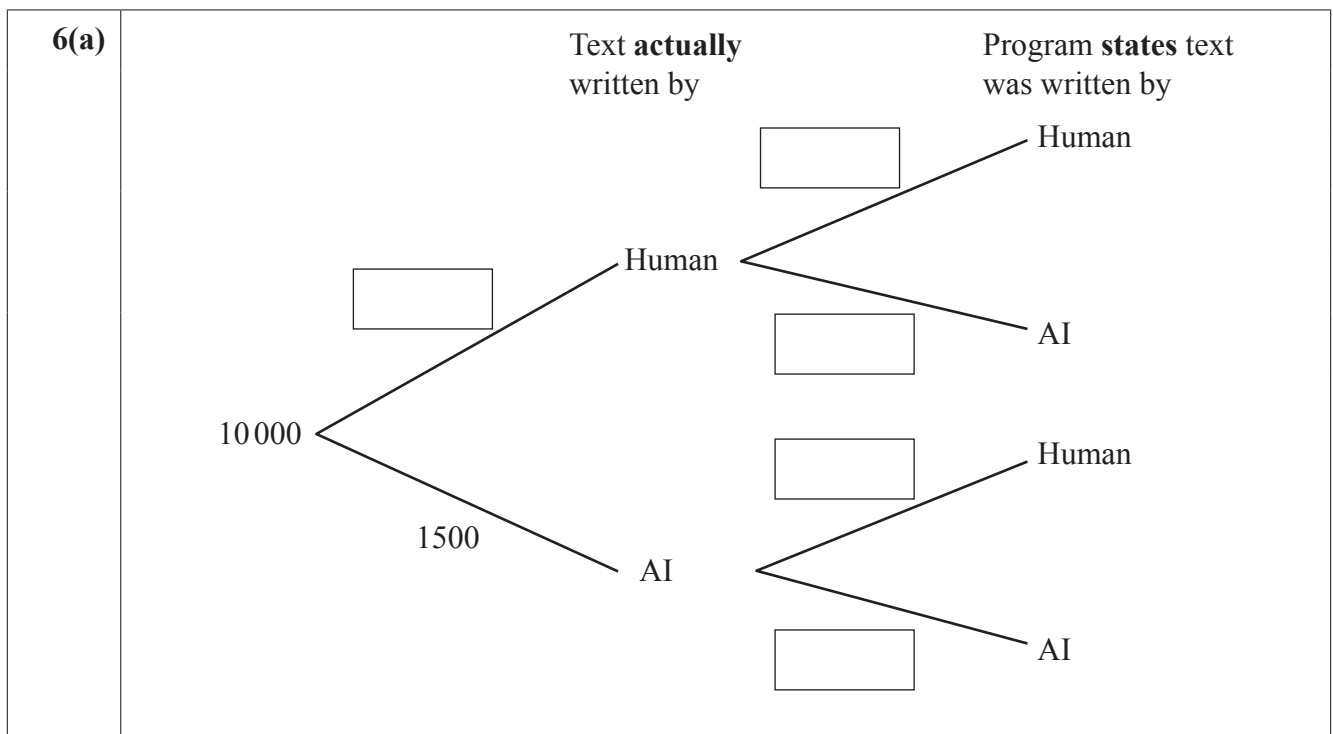
- When the program reads text that was actually written by a human, the probability it **correctly** states it was written by a human is 0.9.
- When the program reads text that was actually written by AI, the probability it **correctly** states it was written by AI is 0.25.

- (a) The program is tested on a sample of 10 000 texts.

The probability that a text in the sample was **actually** written by AI is 0.15.

Complete the tree diagram to show the **expected frequencies**.

[3]



- (b) Calculate the probability that the program states a randomly selected text in the sample was written by AI. [2]
- (c) Calculate the probability that a text the program states was written by AI was actually written by AI. [2]

6(b)	
6(c)	

- (d) Comment on whether the program is a good way to identify text that has been written by AI.

Use data from this question in your answer.

[1]

6(d)	

- 7 This question refers to article B in the pre-release material, ‘**Free childcare for working parents**’.

You can find the article on the Insert accompanying this paper.

- (a) Riley works 10 hours each week and is paid £10.42 per hour.

Show that Riley will **not** be able to get free childcare for her three-year-old child.

[1]

7(a)	

- (b) Estimate the probability that a person chosen at random from the UK population is a child aged over 9 months and less than 5 years.

State clearly any assumptions you make.

[3]

- (c) Estimate the number of children in the UK aged over 9 months and less than 5 years.

State clearly any assumptions you make.

[2]

7(b)	
7(c)	

- (d) The government plan to allocate £8 billion per year for the free childcare in England.

Calculate an estimate for the number of children who could be given 30 hours free childcare per week in term time. [4]

7(d)	

- (e) State **two** reasons why the answer to part (d) is less than the answer to part (c). [2]

7(e)	Reason 1
	Reason 2

- 8** Lecturers at a university want to know whether learning from computer-based study is as effective as learning by attending traditional lectures.

The university has 1250 students on a particular course.

The lecturers randomise students into two groups:

- Group A learns by attending traditional lectures.
- Group B learns from computer-based study.

When both groups have completed their learning, they are given the same test.

- (a) Describe a suitable method for allocating the 1250 students to the two groups at random. [1]
- (b) Explain why it is important to allocate the students to the groups at random. [1]
- (c) Explain why it is **not** possible for this to be a double-blind trial. [1]

8(a)	
8(b)	
8(c)	

(d) A student suggests that it would be better to have three groups in the trial:

- Groups A and B would be as already described.
- Group C would be the control group and would **not** be taught anything.

Is the student correct in saying these three groups would be better than the original two?

Explain your answer.

[1]

8(d)	

- (e) Another course at the university has 729 students on it.

Students on this course experience a mixture of computer-based study and lectures.

All 729 students are asked which method of learning they prefer. They have to choose one or the other.

Consider lots of groups of 729 students being asked which of the two learning methods they prefer.

Imagine the students do **not** really have a preference but have to choose one method.

- (i) What will be the mean number of students who choose lectures? [1]

- (ii) What will be the standard deviation of the number of students who choose lectures? [2]

The lecturer in charge of the course thinks that students are just as likely to choose each of the methods.

The lecturer will conclude that students are **not** just as likely to choose each of the methods if the number of students choosing lectures is more than two standard deviations above or below the mean.

- (iii) How many students need to choose lectures so that the lecturer will conclude that students are **not** just as likely to choose each of the methods? [4]

8(e)(i)	
8(e)(ii)	
8(e)(iii)	

END OF QUESTION PAPER

[illegible]

[illegible]

[illegible]

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